

Renewable Energy for Health System Resilience: Strategies for Planning & Implementation

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Guidance Outline

1. Planning Overview: Scope & Strategy

2. System Assessment

- Assessment Planning
- Data Collection Tool
- Data Collection Framework

3. Implementation

- Design & Engineering
- Procurement of Goods & Services
- Installation Planning
- Quality Control & Monitoring
- Sustainability + O&M

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Planning Overview: Health System & Energy?

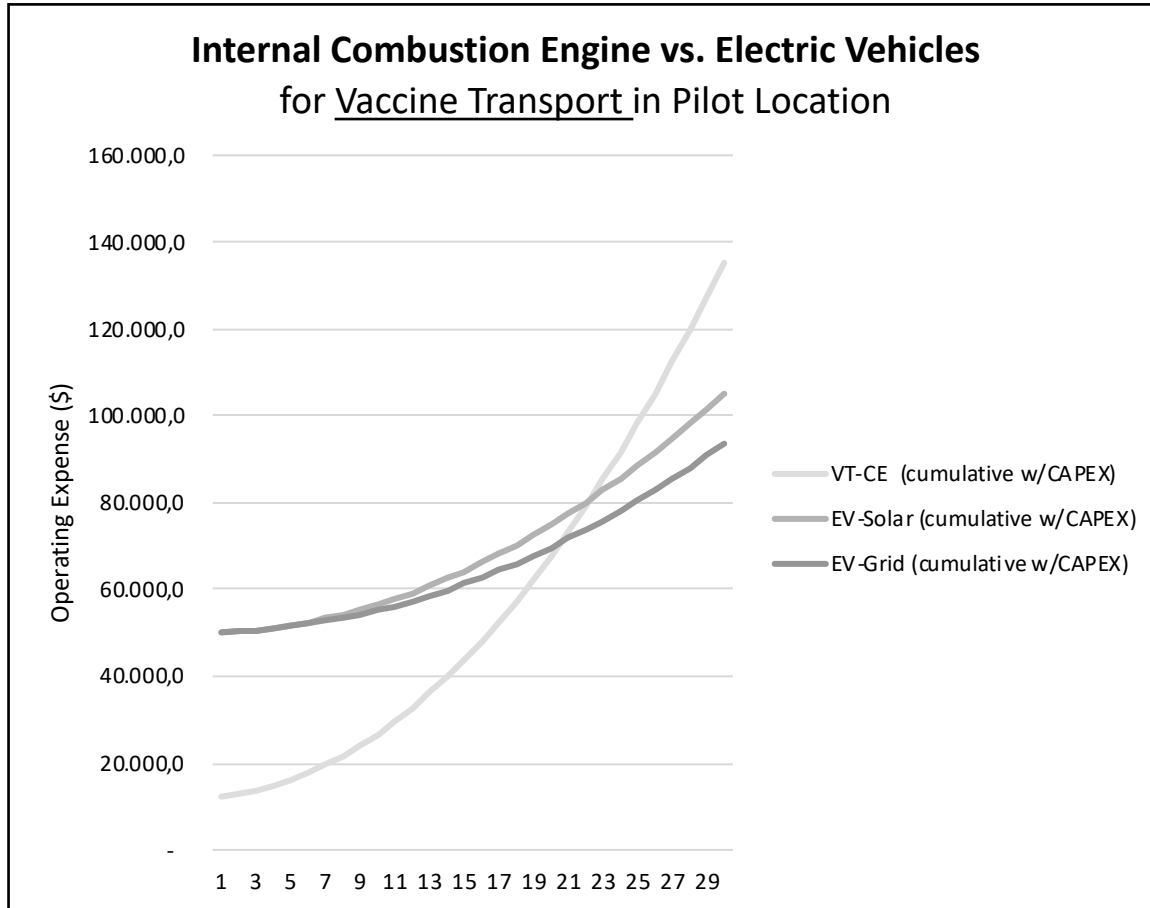
- **Health Clinics:** *Primary Health Care*
- **Cold Rooms & Warehouses for Vaccines:** *Cold Chain*
- **Hospitals:** *Secondary & Tertiary Health Care*
- **Critical Operational Facilities (examples)**
 - Laboratories for Infectious Disease & Surveillance
 - Blood Banks
- **Mobility**
 - Vaccine Transport
 - Referral and Ambulance



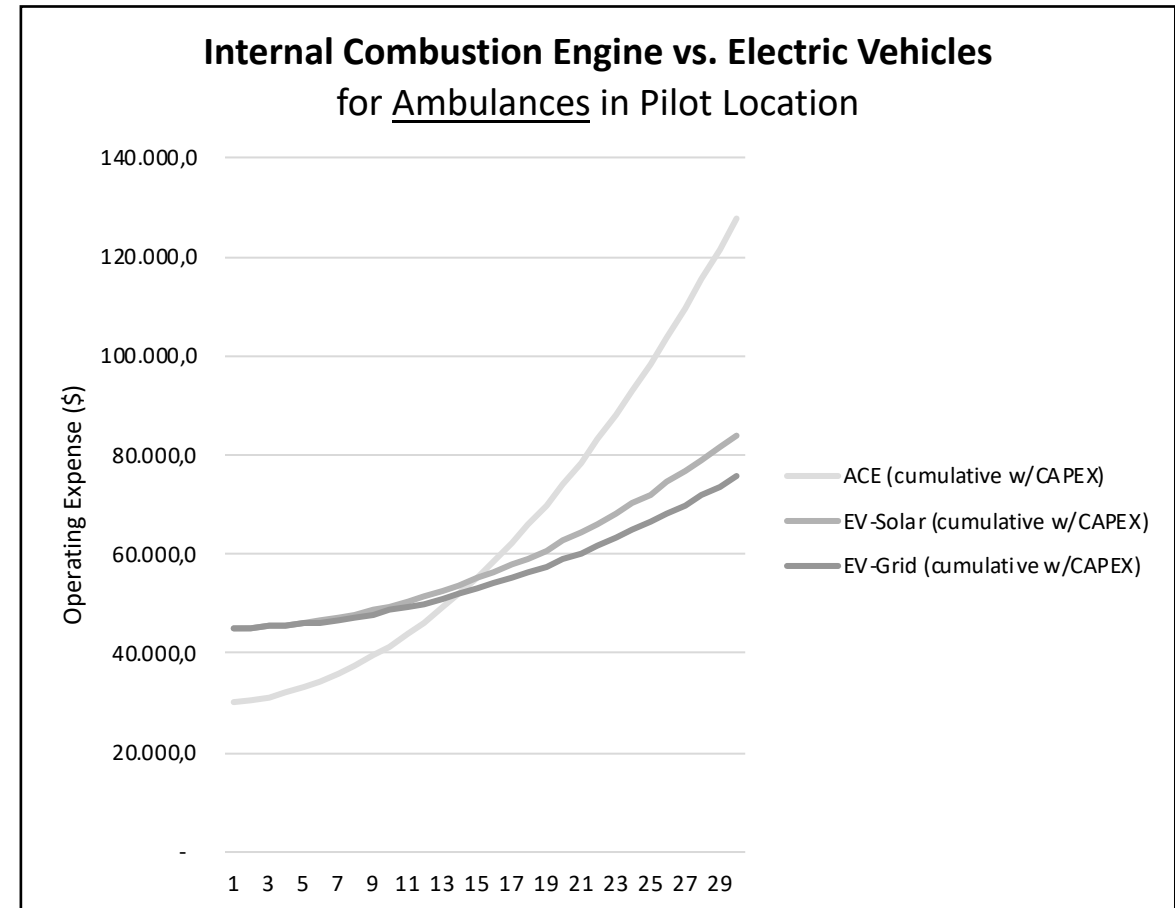
Courtesy of WHO occupied Palestinian Territory
(Nasser Medical Complex, Gaza Strip)



Energy for Mobility in a Health System?



Vaccine Transport: Breaks-even in ~ **20 months**
(VT-CE: Vaccine Transport Combustion Engine)

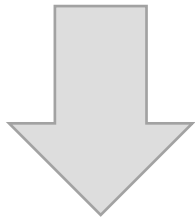


Ambulance Transport: Breaks-even in ~ **15 months**
(ACE: Ambulance Combustion Engine)

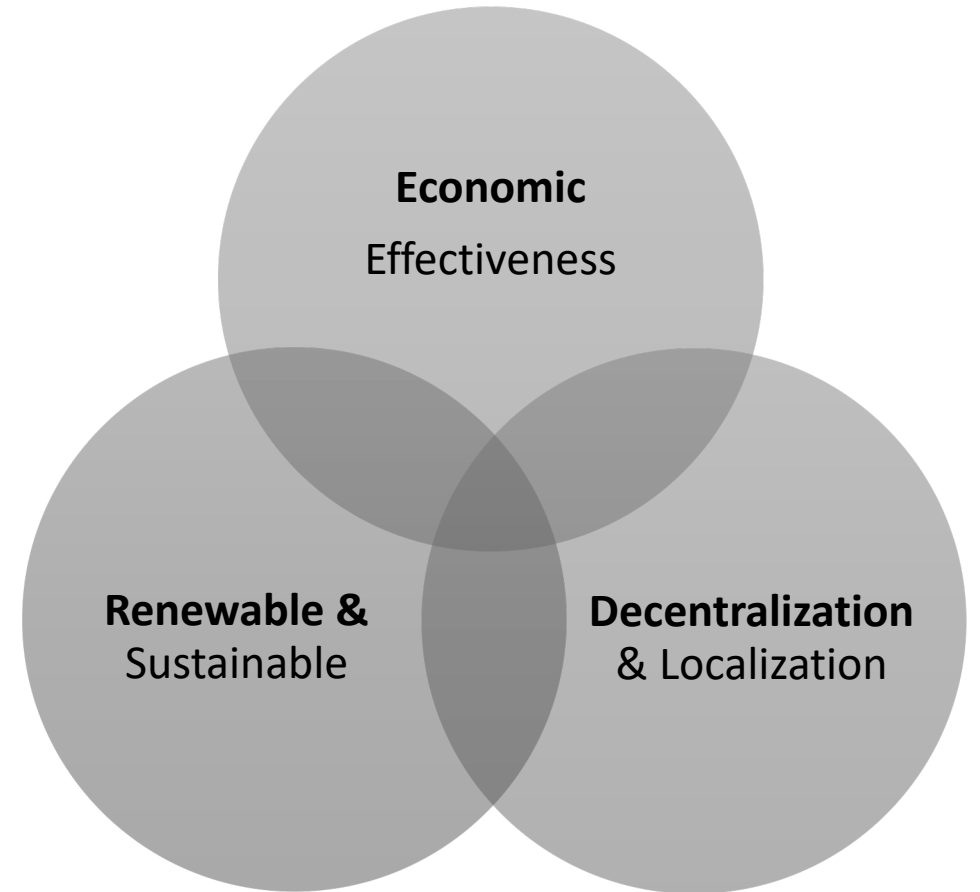
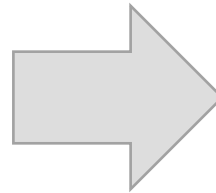
Health & Energy Resilience

Health System Energy Problem:

- No Energy Access
- Diesel Generators (Fuel)
- Weak Unreliable Grid
- Risk of Grid Failure



Solution: Solar PV Electrification



Planning Overview: Types of Applications

Off-grid PV systems (PV + Energy Storage) – 2 sources

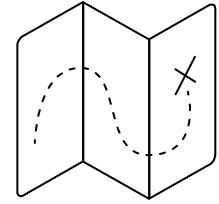
- AC System
- DC System

Hybrid PV-Diesel system with Energy Storage back-up – 3 sources

- Normal Energy Storage
- Lean Energy Storage

Hybrid PV-Diesel-Grid System with & w/o ESS – 4 sources

Planning Overview: Scope & Strategy



What is the scope of the plan?

- Single critical facility?
- Specific group of facilities (critical hospitals, cold chain system, clinics, etc)?
- Integrated Health System Approach for a Country/Region?

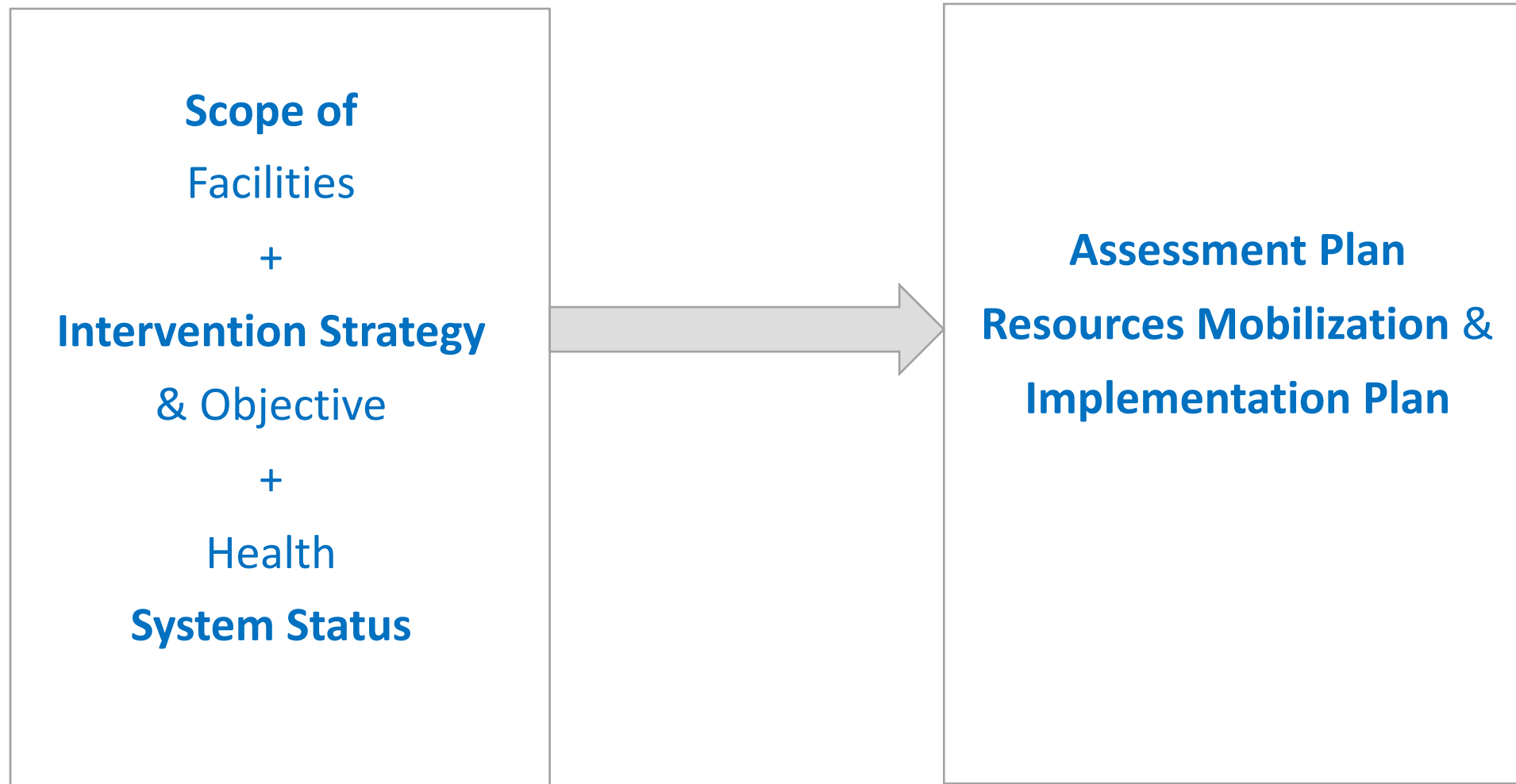
What is the conditions of country/region of intervention?

- Status of Electricity and Primary Sources locally?
- Fuel dependency?
- No Energy Access?

What ensures the system's energy resilience, and what is the priority?

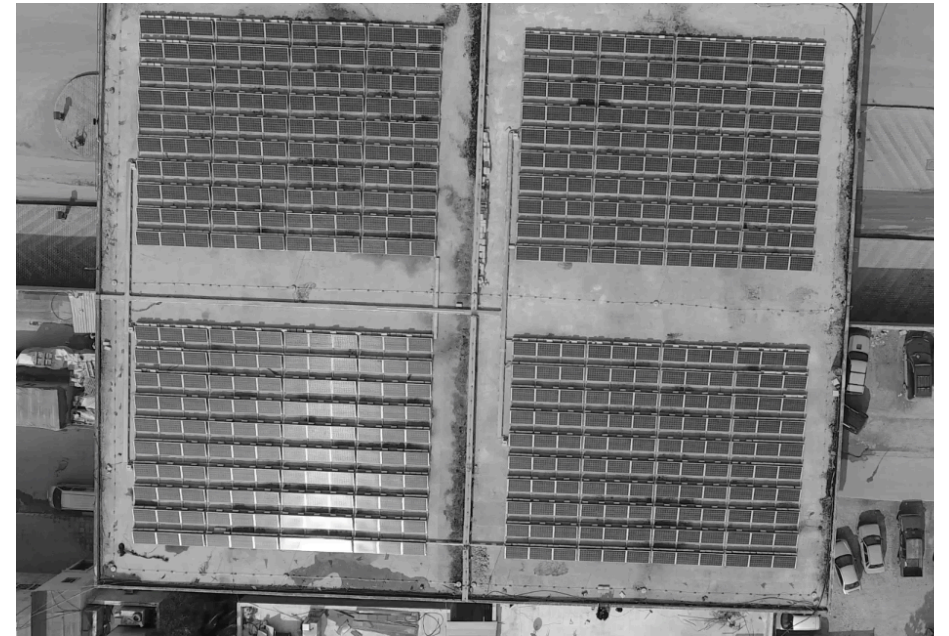
- Full Electrification
- Critical Department for Emergencies
- Cold Chain Only?

Planning Overview: Scope & Strategy



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(General Hospital, North Syria – Courtesy of UOSSM – Syria Solar)

Assessment: Assessment Phases

1. Planning of Assessment

- Identifying Approach & Scope
- Developing the [Data Collection Tool \(Questionnaire\)](#)
- Planning the [Data Analysis Framework](#)

2. Performing Field Data Collection

- Collecting data from sites
- Organizing and cleaning data set

3. Data Analysis and Synthesis

- In accordance with Data Analysis Framework

Data Collection Tool Example
(OPEN SOURCE):

<https://www.kobotoolbox.org/>



(or other internally developed
tools for UN agencies or NGOs)



Assessment: Data Collection Tool

A. General Information

PRIMARY HEALTH CARE (PHC)

B. Health Services (*services, impact, beneficiaries*)

C. Assessment of Space Availability & Conditions (*Roof, Elec. room*)

D. Quantification of Energy Needs

E. Assessment of Energy Infrastructure

Assessment: Data Collection Tool

A. General Information

- Location and Governorate
- Facility Code
- General information
- Facility Management

B. Health Services

- *Health Services:* Types and quantity of services and departments
- Type and category of health facility (For Example Center Classification: 1,2,3)
- Impact & beneficiary quantification
- Categorization for Impact and Geographical Distribution

Assessment: Data Collection Tool

C. Spaces

- Availability of Roof Space & Ground Space
- Battery and Inverter Room (Electrical)

D. Quantification of Energy Needs

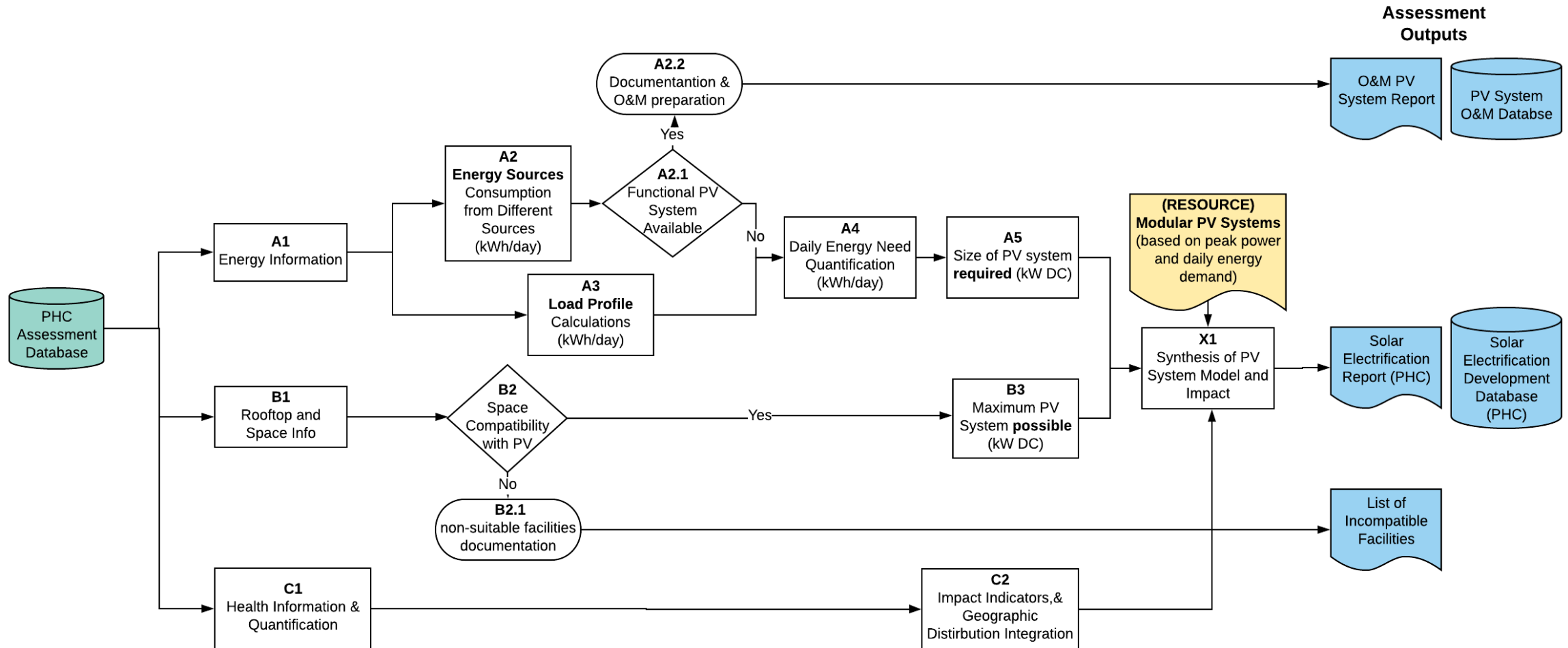
- Energy quantification based on Load Profile (Hospitals Requires Data Loggers)
- Energy quantification based on the source (Diesel, Grid, Others)
- Possible modularization of energy demand based on service/clinic

E. Electricity Infrastructure

- Status of grid availability in the area
- Possible extension to target region

PHC EXAMPLE

Assessment: Data Analysis Framework



Modular Size of PV systems (Example)

Modular PV Systems based on existing & potential energy demand:

- System A | **5 kWp**
- System B | **7.5 kWp**
- System C | **10 kWp**
- System D | **12.5 kWp**
- System E | **15 kWp**
- System F | **20 kWp**



Example of **10 kWp** PHC



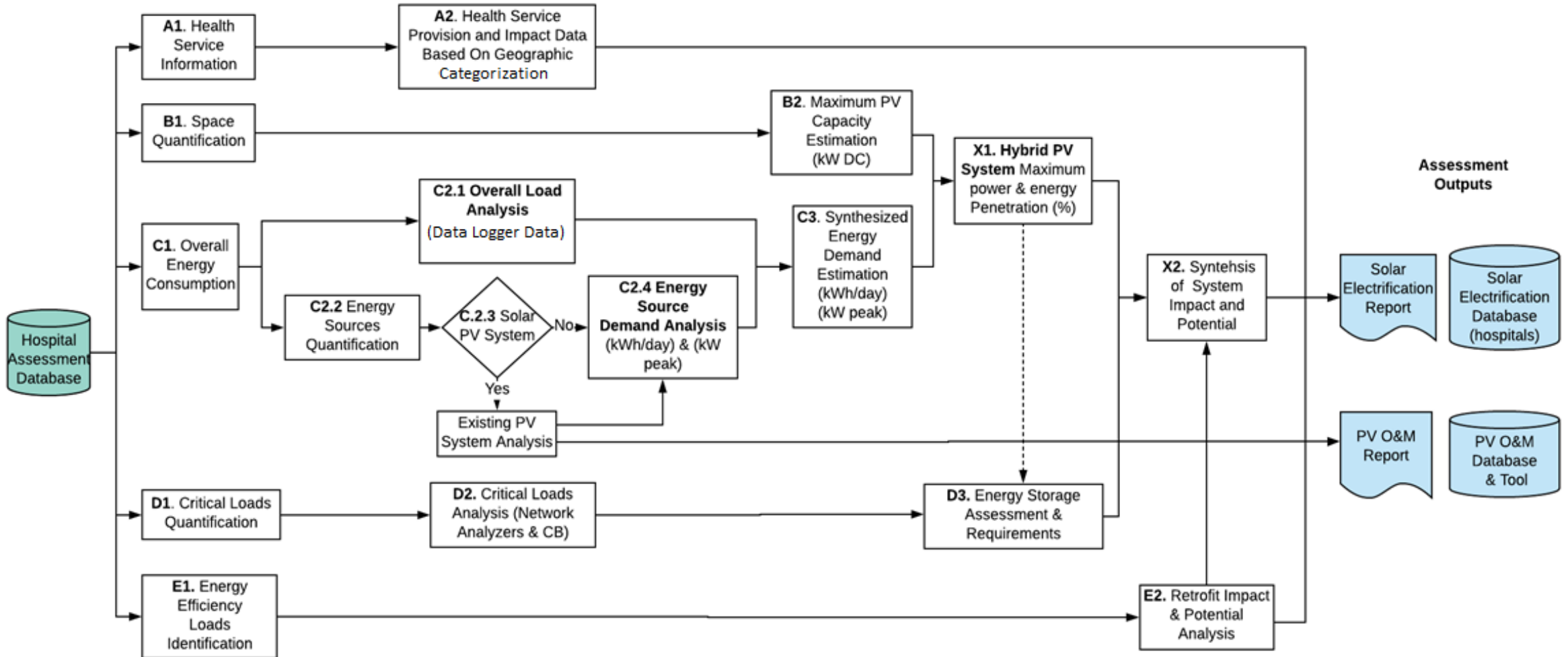
Example of **20 kWp** PHC

(Courtesy of UNICEF – MENARO)

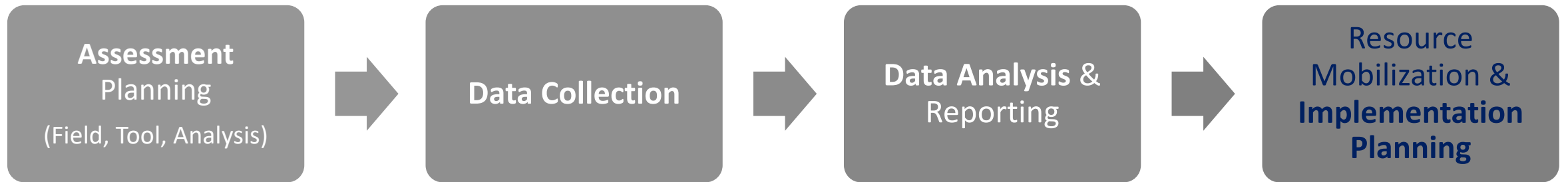
Primary Health Care Center | 5 kWp (Example Load Table)

PHC Center TYPE A 1 5 kWp							
Load Name	Category	Department	Quantity	Load (W)	Total Load (W)	Hours	kWh /day
Fan - 56 Inch	General Services	All	4	30	120	7	0.84
LED Light	General Services	All	5	40	200	7	1.4
Microscope	Medical Equipment	Laboratory	1	100	100	7	0.7
Electric Centrifuge	Medical Equipment	Laboratory	1	230	230	7	1.61
Colorimeter	Medical Equipment	Laboratory	1	60	60	7	0.42
AutoClave	Medical Equipment	Clinic	1	1800	1800	2	3.6
Nebulizer	Medical Equipment	Clinic	1	50	50	7	0.35
Vaccine Fridge (Iceline)	Medical Equipment	Vaccine	1	300	300	11	3.3
Vaccine Freezer (Iceline)	Medical Equipment	Vaccine	1	300	300	11	3.3
Charging - Telephone	IT- Admin	Extra	2	60	120	5	0.6
Laptop	IT- Admin	Extra	1	100	100	12	1.2
LED - Lamps	IT- Admin	Extra	3	35	105	8	0.84
Water Pump	IT- Admin	General	1	1000	1000	2	2
Total							20.16

Assessment: Data Analysis Framework



Assessment: Summary



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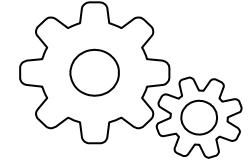
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Implementation: Design & Engineering



Modalities?

- A. *Internal Engineering Unit/Personnel* (In-House)
- B. *Engineering Firm*: Through competitive tender (Local or International)
- C. *External Engineering Entity* (Technical NGOs, Public Entity, University)

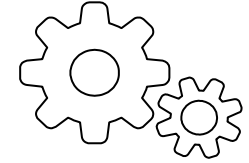
How to decide?

- Your Organizational Capacity
- Local Technical Staff Experience
- Existing Human Resources
- Scale of Project

Functions?

- Assessment Supervision
- Validation & Update of Main DB
- Engineering Study (CAD Layouts, etc)
- Bill-of-Quantities and Specification

Implementation: Design & Engineering



1. Trained **engineering personnel to be engaged as early** as possible
2. Upon **resource allocation** for the project: validation of site conditions, data, and sizing is necessary before installation planning. Especially if long gap between assessment & mobilization.
3. Must take into consideration international markets, advanced technical solutions (new modules technologies, and storage tech like Lithium), and design/installation standards.
4. Prioritize Energy Efficiency measures **before** solar PV electrification.
5. Critical Loads Segmentation & Integration with existing networks.

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Implementation: Procurement of Goods & Services

Modalities?

- A. Turn-Key:** Supplier provides materials + installation services. Engineering personnel (internal/external) to develop spec and supervise procurement.
- B. Segmented:** Informed by qualified personnel, organization procures materials according to spec and BOQ from regional or international markets & engages tender for local installation. Options:
 - Open International/Regional Tenders
 - Long Term Agreements (LTAs)

How to decide?

- Local and regional market access and competitiveness
- Internal capacity of the organization



Implementation: Procurement of Goods & Services

1. **Personnel: Qualified engineering personnel** to lead procurement (RFPs, spec, etc)
2. **Modalities:** Evaluate procurement **options and modalities** considering economic viability, product range, and accessibility.
3. **Effective Technology:** Consider market accessible viable solutions (lithium ESS), and evaluate competitiveness according to **life-time cost**, and **not only initial cost** (levelized cost of kWh – LCOE).
4. **Evaluate Risk:** Consider restrictions **due to remoteness** of target region/location, and integrate mitigation within your procurement strategy.
5. **Build on Experience:** Assess existing implemented solutions locally and extrapolate challenges and lessons learned if any.



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Implementation: Installation Planning

1. **Context Consideration:** Engineering personnel must consider **geographic** and **environmental consideration** in the target region (*variations exists in one country*).
2. **Standardize:** Installation planning must streamline field implementation: including creation of layouts (civil, electrical, mechanical/mounting).
3. **Group:** Consider **grouping** and **clustering facilities** into lots, based on the local market of contractor or project management modality selected.
4. **Codes:** Ensure that *design and installation* best-practices and standards are integrated into the installation planning process considering international **and** local codes.

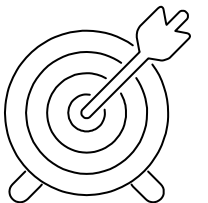
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Implementation: Quality Control & Monitoring

1. **Personnel:** Qualified Engineering Team that conducted Installation Planning should lead the quality control, supervision and monitoring
2. **Authorities:** Advisable to engage technical personnel from the local authorities (Ministries or Directorates of Health, Electricity – if relevant)
3. **Management Unit:** Formulate Supervisory Committee to ensure follow up.
4. **QC/QA:** Quality Control standards shall be in accordance with norms for Installation, Testing, and Commissioning.

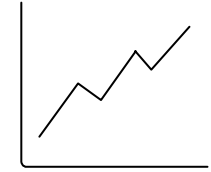


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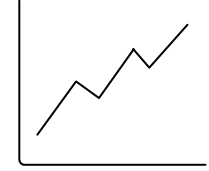


Implementation: Sustainability + O&M

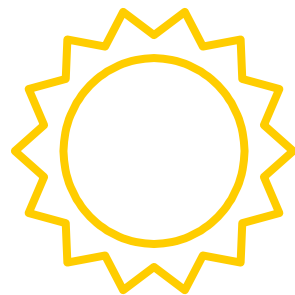


	Option A	Option B
Service Lead	Private Service Provider: 1. Installation company 2. Independent O&M company	Local Authorities (Ministry of Health – Province/State Level)
Description	O&M functions would be performed by the company according to an agreed upon TOR and accountable to the Organization or the health authorities.	The local authorities would be responsible for the O&M functions and would manage the direct activities required.
Pros (+)	Quality Management of the service would more robust due to contractual obligation to meet specified standards.	Contributes to building the internal capacity of the public authority enables.
Cons (-)	Sustainability would be problematic if financial resources are not available. Dependency on external funding.	When weak public administration structure, can cause issues, vandalism, lack of adequate follow up.

Implementation: Sustainability + O&M



1. Plan to integrate O&M function **early** in the process
2. Engage all relevant **stakeholders** (*Health Authorities, Staff Management, Installation Service Providers*)
3. Ensure **modality of O&M monitoring** is in place
4. Consider **financial resource availability for O&M future costs**
5. Consider **battery replacement** costs in the initial planning process



Summary of What to Keep in Mind

Summary: 7 tips for Practitioners

1. Plan well for a comprehensive assessment & **prioritize needs**.
2. **Engage qualified** engineering personnel **as early** as possible.
3. Determine the **best long-term value** for **procurement internationally based on market price, advanced solutions (lithium), and longevity**.
4. Include **technical authorities personnel** early in planning (if relevant).
5. Consider **options for implementation for different phases** based on local conditions, experience, and best-practices.
6. **Pursue standards** in all phases, and **build on previous experience** locally.
7. **Plan well in advance for O&M** (funding, personnel, management)

Thank you

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